corelatus

Product Specification SDH Monitor 3.0

1. Introduction

The SDH Monitor 3.0 is a hardware and software product intended for monitoring SDH STM-1 and SONET OC-3 links, typically in the radio access network of a 2G or 3G mobile network. The extracted information is forwarded via TCP/IP to an application host.

GTH-C3 is the hardware part of the SDH Monitor 3.0. GTH-C3 consists of a 19" chassis, 1U in height, equipped with one STH 3.0 module and two PWR 4.0 power interface modules.

The STH 3.0 module is populated with either one or three independent sub-modules. Each sub-module is equipped with two SFP sockets and two 10/100 ethernet interfaces and can monitor both directions of one STM-1/OC-3 link.

An SDH Monitor 3.0 sub-module can be seen as an SDH/SONET MUX with two STM-1/OC-3 inputs and 126 E1/T1 outputs, followed by a monitor probe.

2. SDH Monitor 3.0 sub-module performance

2.1 Layer 1

2.1.1 Maximum number of simultaneously monitored simplex E1/T1 streams: 126.

2.2 Layer 2 decoding performance

The table below specifies the maximum performance for each protocol. Performance is primarily defined by:
- The maximum number of separate channels that can be monitored simultaneously. This is abbreviated as 'ch' in the table.
- The maximum aggregate input data rate of all of the channels, measured in 64 kbit/s time slots. This is abbreviated as 'TS'.

Two channels are required to monitor both directions of one duplex signalling link. In some applications, only one direction needs to be monitored.

There are two levels of performance: 'Basic' and 'Pro'. The same hardware is used for both; a software licence key selects the performance level.

Protocol	Basic Performance	Pro Performance
2.2.1 MTP-2	32 ch, 32 TS	240 ch, 240 TS
2.2.2 LAPD	320 ch, 320 TS	400 ch, 400 TS
2.2.3 Frame Relay	16 ch, 496 TS	96 ch, 1488 TS
2.2.4 ATM based HSSL	8 ch, 248 TS	16 ch, 496 TS
2.2.5 Transparent Time Slot	64 ch, 64 TS	400 ch, 400 TS

2.2.6 The maximum data rate which can be transmitted via TCP/IP is 48 Mbit/s. The only protocols which can reach that rate are Frame Relay and ATM.

2.2.7 Multiple L2 protocols can be decoded at once. The available performance is distributed linearly across the protocols. Example: on a system with a 'Pro' licence, it is possible to run 95 channels of MTP-2 (39,6% of performance) and 241 channels of LAPD (60,2%) at the same time.

3. SDH Monitor 3.0 hardware specification

3.1 GTH-C3

GTH-C3 is the hardware part of SDH Monitor 3.0. It is the product GTH-C3 that is tested and approved for various EMC and safety requirements.

GTH-C3 consists of:
- A 19" chassis, 1U in height.
- One STH 3.0 module.
- Two PWR 4.0 power interface modules.

The chassis is equipped with SFP and Ethernet connectors and status LEDs on the front and two power connectors (3-pin XLR) and the ground connector on the back.

Other than SFPs, there is no user-serviceable hardware: there are no switches, fuses, batteries or moving parts inside.

3.1.1 Ambient temperature range: 10 - 35 deg. Celsius.
3.1.2 Supply range: 38 - 60 VDC, 7 W (typical per sub-module), 45 W (total max).

3.2 STH 3.0 module

An STH 3.0 module is equipped with either one or three sub-modules. The sub-modules are fully independent of each other and share only the circuit board and the two power inputs from the PWR 4.0 modules.

Each sub-module is equipped with the following interfaces:
- 2 SFP sockets for STM-1/OC-3 SFP modules.
- 2 10/100 Mbit/s ethernet with RJ-45 connector.
- Status LEDs.

STM-1/OC-3 monitor receivers
The optical SDH/SONET interfaces are defined by the SFP (Small Formfactor Pluggable) modules. Multi-mode and single-mode fibres, different wavelengths and connectors are selected by the easily added SFP module. The SFP modules are not part of the product.

3.3 PWR 4.0 module

A PWR 4.0 power interface module contains:
- Over-current protection.
- Over-voltage protection.
- Power filtering.

4. Common, protocol independent, features

4.1 Configuration and control interfaces

4.1.1 SDH Monitor 3.0 has two types of interface, an XML based interface and a Web interface.
4.1.2 The XML interface can be used to configure the module, to query statistics and to reset statistics.
4.1.3 The Web interface can be used to view configuration and statistics. It can not be used for configuration unless specifically stated.

4.2 Control interface asynchronous events

An asynchronous event is sent to the application host via XML when any of the following events occur:
4.2.1 A layer 1 or layer 2 state change occurs.
4.2.2 A configured limit is exceeded (Link, CPU, ethernet, temperature, packet buffer).
4.2.3 The configured time synchronisation source is lost.
4.2.4 A detected module hardware fault.

4.3 Log files

4.3.1 The log shows timestamped alarms and configuration changes.
4.3.2 The log is available via the Web and XML interfaces.

4.4 IP network configuration

4.4.1 At delivery the first ethernet of each sub-module is configured to a default IP address.
4.4.2 The IP address can be configured via the XML or Web interface.
4.4.3 The possibility to configure the IP address from the Web interface can be blocked via the XML or Web interface but can only be unblocked from the XML interface.
4.4.4 Up to two NTP servers can be configured for time synchronisation.

4.5 Environment and performance statistics

Key indicators of the sub-module's environment and performance are available through the following statistics:
4.5.1 Current status of sub-module resources.
4.5.2 Module temperature.
4.5.3 Module power consumption.
4.5.4 The current, maximum and average load of [CPU, ethernet].

4.6 Layer 2 protocol independent features

In all layer 2 protocol monitoring, the monitored data is sent via TCP/IP to an application host, with a header. Signalling on different channels can be sent to different IP address and port pairs.
4.6.1 The header includes a millisecond-resolution timestamp.
4.6.2 Maximum total number of IP address and port pairs: 12.

5. Layer 1 monitoring

5.1 SDH/SONET Layer 1 general

5.1.1 Each STH 3.0 sub-module can monitor two simplex SDH/SONET links.
5.1.2 Both STM-1 and OC-3 links can be monitored.

5.2 SDH/SONET Layer 1 configuration

The following parameters can be configured for each STM-1/OC-3 receiver:
5.2.1 SDH or SONET.
5.2.2 AU-3 or AU-4 (SDH).
5.2.3 TU-11 or TU-12 (SDH), VT1.5 or VT2 (SONET)
5.2.4 Selection of up to 126 simplex E1 or T1 (DS1) streams from up to 2 x 63 E1 or 2 x 84 T1 streams, for further processing in the PDH part.

5.3 SDH/SONET Layer 1 statistics

The following statistics are available for each STM-1/OC-3 receiver:

Regenerator/Multiplex section
5.3.1 RS-LOF/LOF
5.3.2 RS-BIP Error/B1
5.3.3 MS-BIP Error/B2
5.3.4 MS-REI/REI-L
5.3.5 MS-RDI/RDI-L
5.3.6 MS-AIS/AIS-L

High Order Path (HOP)
5.3.7 HP-BIP Error/B3
5.3.8 HP-REI/REI-P
5.3.9 HP-RDI/RDI-P
5.3.10 HP-UNEQ/UNEQ-P
5.3.11 AU-AIS/AIS-P
5.3.12 AU-LOP/LOP-P
5.3.13 TU-LOM/LOM

Low Order Path (LOP)
5.3.14 LP-BIP Error/BIP-2
5.3.15 LP-REI/REI-V
5.3.16 LP-RDI/RDI-V
5.3.17 LP-UNEQ/UNEQ-V
5.3.18 TU-AIS/AIS-V
5.3.19 TU-LOP/LOP-V

5.4 PDH Layer 1 configuration

The following parameters can be individually configured for each E1/T1 stream:
5.4.1 E1 framing: Doubleframe or CRC-4 Multiframe.
5.4.2 T1 framing: Superframe or Extended Superframe.

5.5 PDH Layer 1 statistics

The following statistics are available for each E1/T1 stream:
5.5.1 Current link state: (OK, LFA, LMFA, RAI, AIS).
5.5.2 The number of occurances of [slip(+), slip(-), Frame error, CRC error].
5.5.3 State statistics: The total duration of each state and the number of times the state is entered [OK, LFA, LMFA, RAI, AIS].

6. MTP-2 monitoring

6.1 General

MTP-2 monitoring specifies software for monitoring MTP-2 traffic, according to Q.703.

The monitored signal units are extracted, filtered and sent via TCP/IP to an application host. Statistics are gathered.

Definition: Maximum load is defined as nonstop 40 octet signal units separated by a single flag.

Definition: A channel is created by concatenating one or several time slots. The data rate of a channel is thus an integer multiple of 64 kbit/s.

6.1.1 A channel can consist of 1 to 31 time slots from the same E1/T1 stream.
6.1.2 56 kbit/s channels as per ANSI T1.111 are supported.
6.1.3 Maximum load on all channels simultaneously is supported.

6.2 MTP Layer 2 configuration

The following parameters can be individually configured for each channel:
6.2.1 Channel specification: (E1/T1 stream [1..N], list of time slots).
6.2.2 Destination host IP and port address.
6.2.3 FISU filter (Filter none, filter identical, filter all).
6.2.4 LSSU filter (Filter none, filter identical, filter all).
6.2.5 MSU filter (Filter none, filter all).

6.3 MTP Layer 2 statistics

The following statistics are available for each channel:
6.3.1 Current channel state: (In service, Out of service, Processor outage, Congestion).
6.3.2 SU statistics: The number of occurences and octets of: [FISU, LSSU, MSU, Errored SU, Retransmitted MSUs].
6.3.3 The number of occurences of: [FIB inversions, BIB inversions].
6.3.4 Channel load (in Erlang): [current, maximum, average].
6.3.5 State statistics: The total duration of each channel state and the number of times the state is entered [In service, Out of service, Processor outage, Congestion].

7. LAPD monitoring

7.1 General

LAPD monitoring specifies software for monitoring LAPD traffic, according to Q.921.

The monitored LAPD frames are extracted, filtered and sent via TCP/IP to an application host. Statistics are gathered.

Definition: Maximum load is defined as nonstop 40 octet frames separated by a single flag.

Definition: A channel is in state "Up" if the idle pattern is flags and the time between two correct frames is less than specified, otherwise it is in state "Down".

7.1.1 The monitored time slots can be selected from among the time slots in the E1/T1 streams. The API manual describes how to use the maximum number of concurrent channels.
7.1.2 16, 32 and 64 kbit/s time slots are supported.
7.1.3 Maximum load on all channels simultaneously is supported.

7.2 LAPD configuration

The following parameters can be individually configured for each channel:
7.2.1 Channel specification: (E1/T1 stream [1..N], time slot [1..31]).
7.2.2 Destination host IP and port address.
7.2.3 Forward correct frames (yes/no). (Statistics gathering only)
7.2.4 Forward errored frames (yes/no). (Error analysis)
7.2.5 Idle timer, configurable from 0-1000 s.

7.3 LAPD statistics

The following statistics are available for each channel:
7.3.1 Current channel state [Up, Down].
7.3.2 The total number of frames received.
7.3.3 The total number of octets received.
7.3.4 The total number of errored frames.
7.3.5 Channel load (in Erlang): [current, maximum, average].
7.3.6 State statistics: The total duration of each channel state and the number of times the state is entered [Up, Down].

8. Frame relay monitoring

8.1 General

Frame relay monitoring specifies software for monitoring frame relay traffic, according to Q.922 core.

The monitored frame relay frames are extracted, filtered and sent via TCP/IP to an application host. Statistics are gathered.

Definition: Maximum load is defined as a nonstop stream consisting of a 1500 octet frame followed by a 64 octet frame, separated by a single flag.

Definition: A channel is created by concatenating one or several time slots. The data rate of a channel is thus an integer multiple of 64 kbit/s.

Definition: A channel is in state "Up" if the idle pattern is flags and the time between two correct frames is less than specified, otherwise it is in state "Down".

8.1.1 A channel can consist of 1 to 31 time slots from the same E1/T1 stream.
8.1.2 The maximum supported frame length is 1600 octets.
8.1.3 Maximum load is supported on all channels, as long as the limit in 2.2.6 is not exceeded.

8.2 Frame relay configuration

The following parameters can be individually configured for each channel:
8.2.1 Channel specification: (E1/T1 stream [1..N], list of time slots).
8.2.2 Destination host IP and port address.
8.2.3 Forward correct frames (yes/no). (Statistics gathering only)
8.2.4 Forward errored frames (yes/no). (Error analysis)
8.2.5 Idle timer, configurable from 0-1000 s.

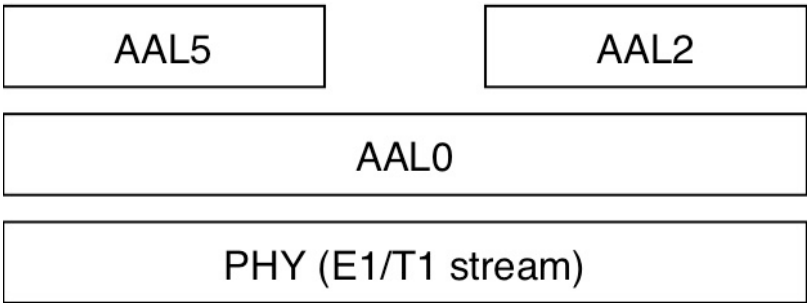
8.3 Frame relay statistics

The following statistics are available for each channel:
8.3.1 Current channel state [Up, Down].
8.3.2 The total number of frames received.
8.3.3 The total number of octets received.
8.3.4 The total number of errored frames.
8.3.5 Channel load (in Erlang): [current, maximum, average].
8.3.6 State statistics: The total duration of each channel state and the number of times the state is entered [Up, Down].

9. ATM monitoring

9.1 General

This section specifies software for monitoring several interfaces in the ATM stack:



Monitoring at the AAL0, AAL2 and AAL5 interfaces is supported. The monitored information is extracted, filtered and sent via TCP/IP to an application host. Statistics are gathered.

Definition: A channel is created by concatenating one or several time slots. The data rate of a channel is thus an integer multiple of 64 kbit/s.

9.1.1 A channel can consist of 1 to 31 time slots from the same E1/T1 stream.

The following parameters can be individually configured for each channel:
9.1.2 Channel specification: (E1/T1 stream [1..N], list of time slots).
9.1.3 Destination host IP and port address.
9.1.4 De-scramble ATM cell payload (yes/no).
9.1.5 Maximum number of VPI/VCI pairs available to higher layers: 3.

9.2 ATM AAL0

The AAL0 layer allows direct access to ATM cells. It is described in ITU-T I.361.

Definition: Maximum load is defined as nonstop cells.

9.2.1 Maximum load on an AAL0 channel is supported.

The following parameters can be individually configured for each channel:
9.2.2 Forward user cells (yes/no).
9.2.3 Forward OAM cells (yes/no).
9.2.4 Forward cells with a corrupt header (yes/no).
9.2.5 Forward idle cells (yes/no).

The following statistics are available for each channel:
9.2.6 The current channel state (Hunt/Sync).
9.2.7 The total number of received ATM cells.
9.2.8 The total number of errored ATM cells.
9.2.9 The total number of idle ATM cells.
9.2.10 Channel load (in Erlang): [current, maximum, average].
(Calculated as correct non-idle/all received ATM cells.)
9.2.11 The number of times the channel has been in Hunt and Sync state.
9.2.12 The total time the channel has been in Hunt and Sync state.

9.3 ATM AAL2

AAL2 monitoring allows access to the interface above the CPS sublayer defined in ITU-T I.363.2.

Definition: Maximum load is defined as nonstop 40 octet frames.

9.3.1 Maximum load is supported on all channels, as long as the limit in 2.2.6 is not exceeded.

The following parameters can be individually configured for each channel:
9.3.2 Forward SDUs (yes/no).
9.3.3 Forward corrupt SDUs (yes/no).
9.3.4 Load limit.
9.3.5 Time out.

The following statistics are available for each channel:
9.3.6 The total number of received SDUs.
9.3.7 The total number of errored SDUs.
9.3.8 The total number of received SDU octets.

9.4 ATM AAL5 (HSSL)

AAL5 monitoring allows access to the interface above the CPCS sublayer defined in ITU-T I.363.5. One intended use is monitoring High Speed Signaling Links (HSSLs).

Definition: Maximum load is defined as nonstop 100 octet frames.

9.4.1 Maximum load is supported on all channels, as long as the limit in 2.2.6 is not exceeded.

The following parameters can be individually configured for each channel:
9.4.2 Forward SDUs (yes/no).
9.4.3 Forward corrupt SDUs (yes/no).
9.4.4 Load limit.
9.4.5 Time out.

The following statistics are available for each channel:
9.4.6 The total number of received SDUs.
9.4.7 The total number of errored SDUs.
9.4.8 The total number of received SDU octets.

10. Transparent time slot monitoring

10.1 General

The contents of a 64 kbit/s time slot are sent, bit-exact, via TCP/IP to an application host. No decoding or transcoding is performed on the time slot data.

10.2 Transparent time slot configuration

The following parameters can be individually configured for each monitored time slot:
10.2.1 Destination host IP and port address.

Revision history

Rev. 1.9 dated 200511
- Modified 2.2.5. Increased Transparent performance (Pro) to 400/400 ch/TS.

Rev. 1.8 dated 180205
- Modified 2.2.1 and 2.2.7. Increased MTP-2 performance to 32/32 (Basic) and 240/240 (Pro) ch/TS.

Rev. 1.7 dated 160201
- Modified 2.2.2 and 2.2.7. Increased LAPD Pro performance to 400 ch, 400 TS.

Rev. 1.6 dated 141216
- Removed 2.2.6 associated with chapter 11 and renumbered.

Rev. 1.5 dated 141030
- Corrected 2.2.8.
- Removed chapter 11.

Rev. 1.4 dated 141022
- 2.2.1 Increased MTP-2 performance.
- 2.2.4 Decreased ATM based HSSL performance.

Rev. 1.3 dated 130925 Major rework from earlier spec.